# OASIS II


## Chris Seebregts

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**Department of Computer Science, University of KwaZulu-Natal**

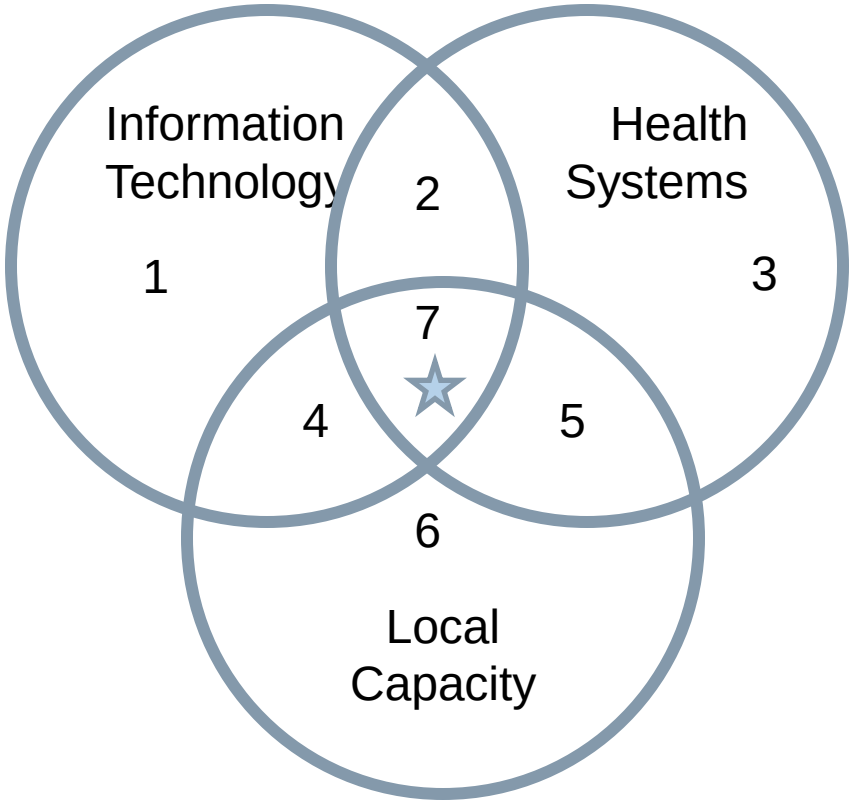
**Jembi**

**SOUTH AFRICA**


South African Medical Research Council

BUILDING A HEALTHY NATION THROUGH RESEARCH

# Problem Domain



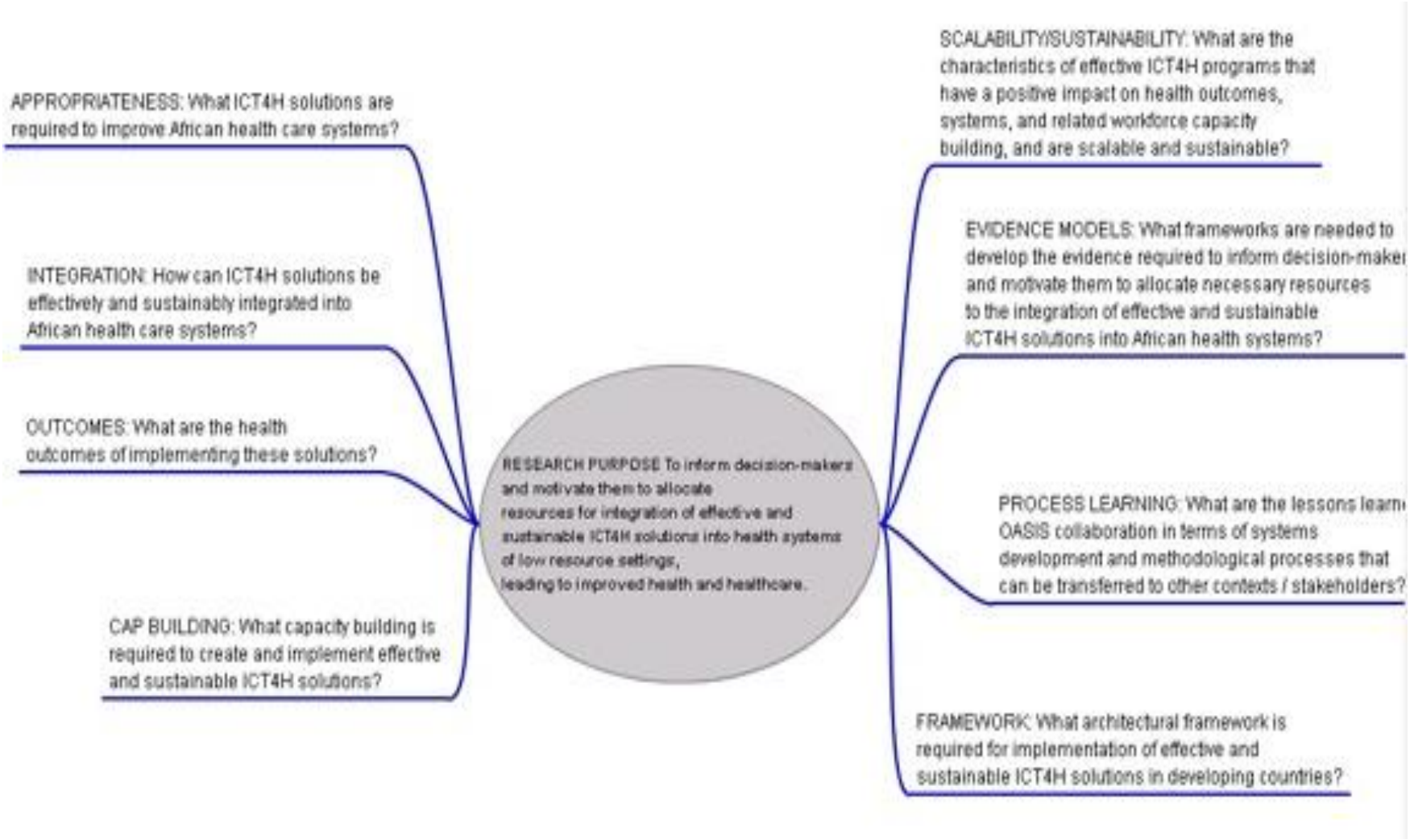
# OASIS II Sub-projects

- OASIS Core
- Open Architectures
- Millennium Villages Project (MVP)
- OpenROSA / JavaROSA
- Rwanda OpenMRS and Informatics Training Program

# Shared Research Question

- **How can decision-makers be informed and motivated to allocate resources for integration of effective and sustainable HIS solutions into health systems of low resource settings, leading to improved health and healthcare.**

# Mind Map of OASIS II Research Framework



# Eight Specific Sub-Questions

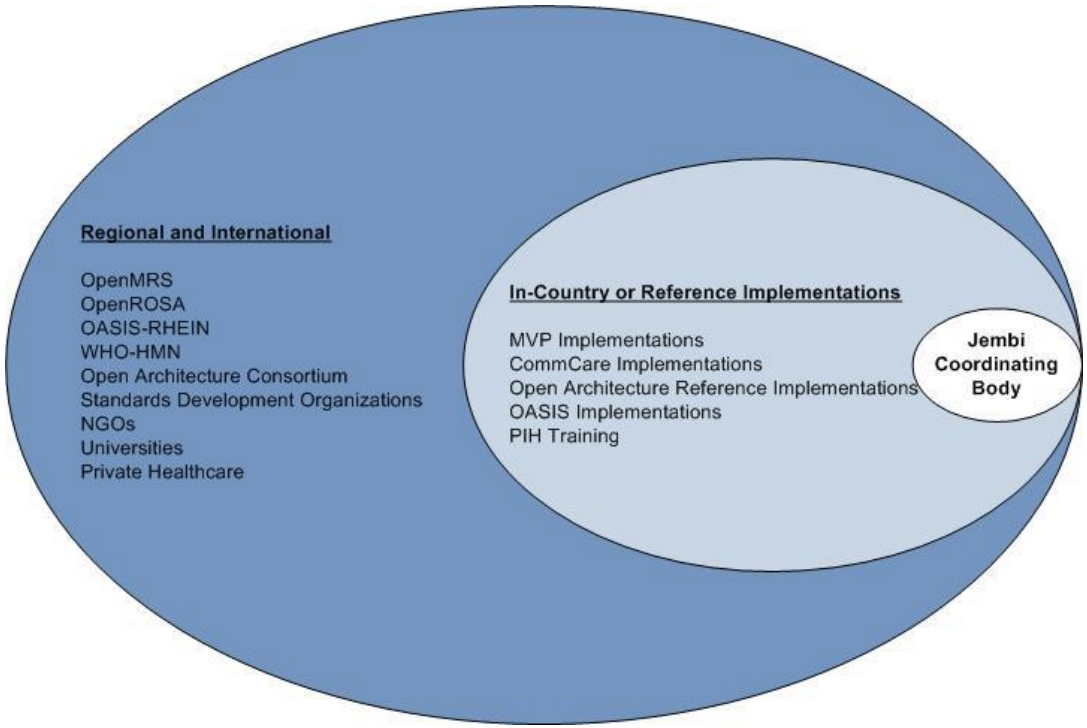
- **APPROPRIATENESS. What HIS solutions are optimally suited to improve African healthcare systems?**
- **INTEGRATION. How can HIS solutions be effectively and sustainably integrated into African healthcare systems?**
- **OUTCOMES. What are the health outcomes of implementing these solutions?**
- **CAPACITY BUILDING. What capacity building is required to create and implement effective and sustainable HIS solutions?**
- **SCALABILITY&SUSTAINABILITY. What are the characteristics of effective HIS programs (those that have a positive net impact on health outcomes, systems and related workforce capacity building) that are scalable and sustainable?**
- **EVIDENCE MODELS. What frameworks and processes are needed to develop the evidence required to inform decision-makers and motivate them to allocate necessary resources to the integration of effective and sustainable HIS solutions into African health systems?**
- **PROCESS LEARNING. What are the good practices and lessons learned from the OASIS II collaboration in terms of systems development, methodological processes, and networking practices that can be transferred to other contexts / stakeholders?**
- **FRAMEWORK. What architectural framework is appropriate for the implementation of effective and sustainable HIS solutions in developing countries?**



# Five Cross-Cutting Research Questions

- How can electronic information systems be integrated into African healthcare delivery?
- How can local capacity and local ownership be strengthened?
- Do electronic information systems improve healthcare delivery and health outcomes?
- How can interoperability among these systems be improved?
- How can coordination and collaboration among those developing electronic health systems be improved?




Regional and International
OpenMRS
OpenROSA
OASIS-RHEIN
WHO-HMN
Open Architecture Consortium
Standards Development Organizations
NGOs
Universities
Private Healthcare
In-Country or Reference Implementations
MVP Implementations
CommCare Implementations
Open Architecture Reference Implementations
OASIS Implementations
PIH Training
Jembi Coordinating Body

# Overarching Objectives

- **ICT/Health Integration: To evaluate various technical and operational effects of deploying eHealth solutions within the health care systems at the different reference implementation sites.**
- **Local Capacity: To build the capacity of health practitioners (community health workers, nurses, midwives, doctors, etc.), software developers and policy makers through training programs, evidence-based advocacy campaigns and targeted research communications activities.**
- **Health Outcomes: To develop a theory of change and general research methodology framework based on the research question: Do open and interoperable HIS systems improve the quality, timeliness, and use of data toward the achievement of better health outcomes in low-resource health systems? If so, what technical and operational factors contribute to the improvement?**
- **Interoperability/ Architecture: To develop and publish the specifications of a robust, scalable and interoperable open eHealth enterprise architectural framework, based on reference implementations, to allow for the construction and deployment of interoperable eHealth systems for the Global South (GS) – with the initial focus in Africa.**
- **Process Learning/ Collaboration: To strengthen collaboration within and between different FOSS-based communities such as OpenMRS and OpenROSA.**



# Possible Designs, Methods, and Techniques

**Richard Scott**

# Possible 'Designs'

## (or 'The Basic Direction')

- **Experimental – RCT**
- **Quai-experimental**
- **Case studies**
- **Rapid appraisal**
- **Collaborative action inquiry**
- **Agile development**
- **Retroductive reconstruction**

- Utilisation focussed evaluation
- Most significant change
- Outcome mapping
- Literature review
  - Systematic
  - Realist



# Possible 'Methods'

## (or 'Approaches' / 'Knowledge Desired')

- Case studies
  - Single
  - Comparative
- Life history / oral history
- Survey
- Ethnography
- Participatory techniques
- Rapid appraisal
- Policy research
- Implementation Research



# Possible 'Techniques'

## (or 'Tools' / 'How you get it')

- Interviews (structured; semi-structured; open-ended; free association; in-depth; participatory; dialogue)
- Observation ((structured; semi-structured; open-ended (hanging around); 'e-hanging')
- Expert Interviews
- Questionnaires
- Surveys
- Time budgeting
- Time and motion
- Delphi
- Panels
- Document review (chart review)
- Content analysis
- Economic analyses (e.g. CEA, CBA)
- EMR database content analysis



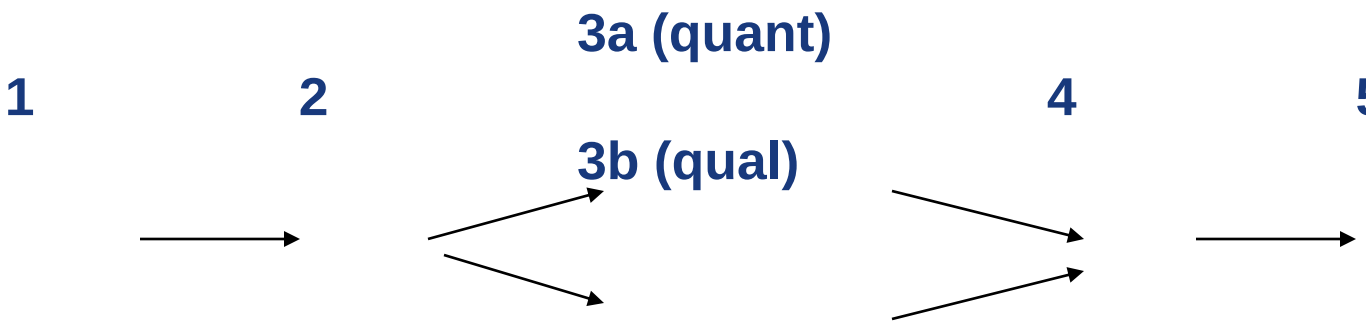
# Thoughts
## (Putting it Together)

**Method** **Technique**

- Who
- **What**
- **Why**
- Where
- When
- **How**

# OASIS II "Framework"

1. Methodology to describe unique situation in each partner project (using 'Shared purpose / goal' and 'shared questions').
2. Share findings with existing OASIS II community (methodology – dash board – but-in). Decision point – various partners coming together for different common 'projects').
3. Harmonise data collection process. Identify and transfer common research question, tools, terminology, methodology, to community, and methodology to share operationalisation process.
4. Assess results from common project.
5. Process to transfer findings into a larger definitive study or publication.



# OASIS Research Methodology Meeting

**Chris Seebregts**

**eHealth Research & Innovation Platform, Medical Research Council**

**Department of Computer Science, University of KwaZulu-Natal**

**Jembi**

**SOUTH AFRICA**

South African Medical Research Council

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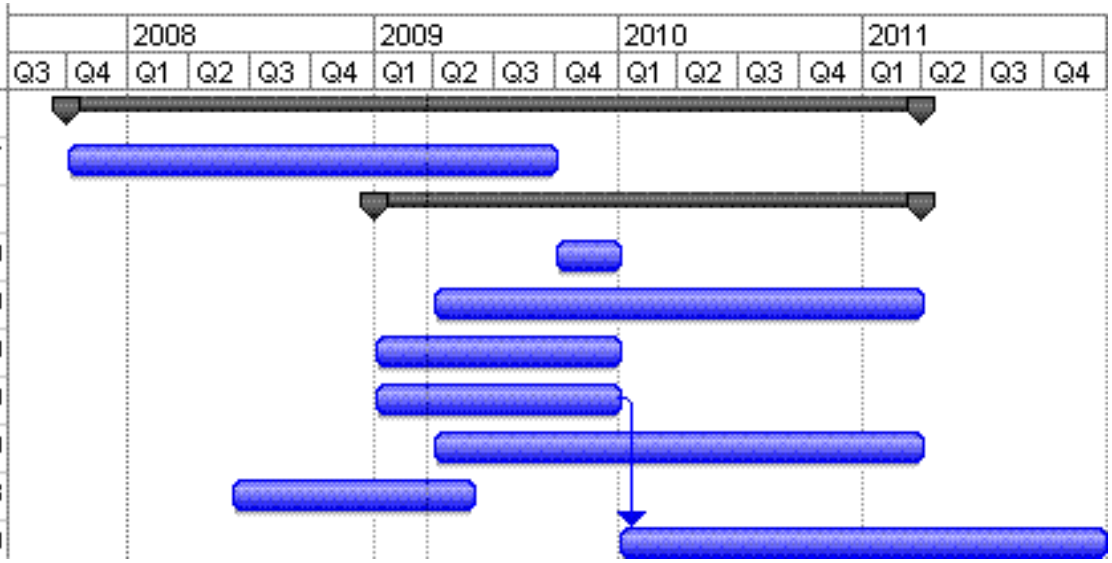
# Workshop Aim and Objectives

- **The main aim of this meeting is to develop a research methodology to serve as a common basis for all projects funded through the OASIS projects.**
- **Five Specific Objectives:**
  - **Introduce the Goals and Research Objectives of existing OASIS projects.**
  - **Critically review existing research methodology and policy framework and consider other possible candidate research methodologies.**
  - **Develop and refine a consensus research methodology and adopt/develop specific approaches and tools.**
  - **Customize research methodology and refine research objectives for individual projects.**
  - **Develop an implementation strategy and roadmap for individual projects.**



# ICT4D Projects

| Task Name | Duration | Start |
|---|---|---|
| **ICT4D Projects** | **914 days** | **Mon 10/1/07** |
| OASIS I | 523 days | Mon 10/1/07 |
| **OASIS II** | **586 days** | **Thu 1/1/09** |
| OASIS suppl | 66 days | Thu 10/1/09 |
| OpenArch | 522 days | Wed 4/1/09 |
| ROSA | 261 days | Thu 1/1/09 |
| MVP | 261 days | Thu 1/1/09 |
| RHEIN | 522 days | Wed 4/1/09 |
| PIH Training | 260 days | Mon 6/2/08 |
| MVP2 | 521 days | Fri 1/1/10 |



# The Action Research Approach

- **A group of research methods designed to promote action and change. Its key feature is a cyclical process between action and critical reflection so that data collection and interpretation are continuously refined in the light of the understandings developed in earlier cycles. It is an emergent process which takes shape as understanding increases and an iterative process which leads towards a better understanding of the area under investigation. Action research uses mainly qualitative methods because it is concerned with participants' meanings and understanding. It is usually participative since change is more easily achieved when those affected are involved in the process**



# Outcome Mapping

- Outcome Mapping focuses on one specific type of result: outcomes as behavioural change. Outcomes are defined as
- changes in the behaviour, relationships, activities, or actions of the people, groups, and organizations with whom a
- program works directly. These outcomes can be logically linked to a program's activities, although they are not
- necessarily directly caused by them. These changes are aimed at contributing to specific aspects of human and ecological
- well-being by providing partners with new tools, techniques, and resources to contribute to the development process.
- Boundary partners are those individuals, groups, and organizations with whom the program interacts directly
- and with whom the program anticipates opportunities for



# Agile Software Development

- **Agile software development is a group of software development methodologies that are based on similar principles. Agile methodologies generally promote a project management process that encourages frequent inspection and adaptation, a leadership philosophy that encourages teamwork, self-organization and accountability, a set of engineering best practices that allow for rapid delivery of high-quality software, and a business approach that aligns development with customer needs and company goals. Conceptual foundations of this framework are to be found in modern approaches to operations management and analysis such as lean manufacturing, soft systems methodology, speech act theory (network of conversations approach), and Six Sigma.**



# Evaluation and Alteration

- **Action research driving Agile development**
- **Strategy may be conducted in an Agile fashion. Change however must be motivated.**
- **The iterative evaluation of Action research and its evaluation component provide motivation for the adjustment of strategies.**

# Current Proposal

## Chris Seebregts

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MRC SOUTH AFRICA

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# Underlying Principles for an integrated eHealth Architecture

- **Integrated eHealth systems should support and facilitate access to the most relevant health research, information and education, for managers, providers, researchers, and population**
- **Integrated eHealth systems should support the wellness of the individual, family, and community. In addition it should also support frontline health professions as well as public health services, health promotion, preventative interventions, particularly in resource-poor environments.**
- **EHealth should offer appropriate, complete, consistent and interoperable health information systems that integrate all aspects of health including public health and clinical requirements**



# Objectives/Outputs of Project

- The first version of an eHealth Framework Architecture for African Countries
- A library of relevant health Informatics standards
- A library of reviews of current successful experiences of deploying large and complex integrated eHealth systems
- An inventory of current health information systems (HIS) in use in Africa
- An eHealth Assessment Toolkit
- Reference implementations in at least two African countries
- An interactive web repository



# Project Team

- **Project Team**
  - **Chris Seebregts (Convener)**
  - **Beatriz F. Leão, Zilics Information Systems**
  - **Michael Bainbridge, NHS Connecting for Health**
  - **Paul Biondich, Regenstrief Institute, University of Indiana**
- **Current Nominees for Scientific Steering Committee**
  - **Ed Hammond (Chair)**
  - **Karl Brown, Rockefeller Foundation**
  - **Sally Stansfield, Health Metrics Network**
  - **Christopher Bailey, Healthcare Informatics Department, WHO**
  - **Charles Jaffe, CEO, HL7**
  - **Ken Lunn, NHS Connecting for Health**
  - **Joseph Jazinski, Healthcare and Lifesciences Institute, IBM Research**
  - **Dennis Israelski, Vice-President, InSTEDD**
  - **Hamish Fraser, Technical Director, Partners in Health**
- **Collaborative Action Network**



# Collaborators

- Health Metrics Network
- WHO Healthcare Informatics Department
- HL7
- Path
- InSTEDD
- IBM Research
- Partners in Health
- Centers for Disease Control
- Canada Health InfoWay
- Ifakara Health Institute

# Outputs

- eHealth Framework Architecture
- Library of health Informatics standards
- Library of integrated eHealth Systems
- Report on National eHealth Policies
- Inventory of current health information systems in use in Africa
- An eHealth Assessment Toolkit
- Reference Implementations
- Project web site and conferencing tools



# Group Review

## Chris Seebregts

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# Group Discussions Briefing

- Business Requirements
- Outcomes
- Scope (how far into the domain do we go)?
- Risks and Mitigation
- Process and Methods
- Partners and interfacing with other projects

# Developing an Open eHealth Enterprise Architectural Framework for Developing Countries


## Chris Seebregts, PhD

**eHealth Research & Innovation Platform, Medical Research Council**

**Department of Computer Science, University of KwaZulu-Natal**

## Jembi

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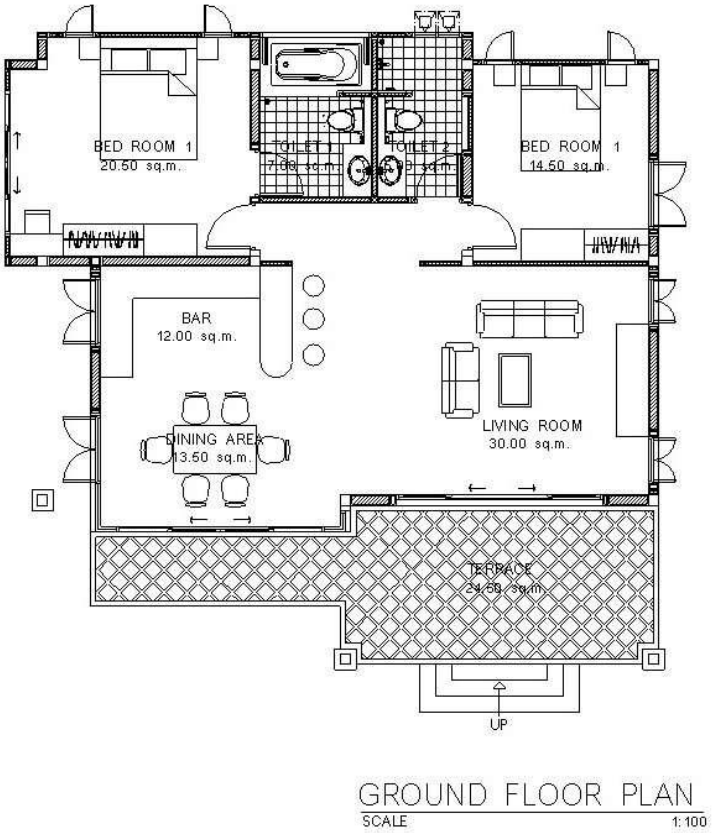
# Analogy of Building Architecture

## Minimal Architecture


## Architecture Essential

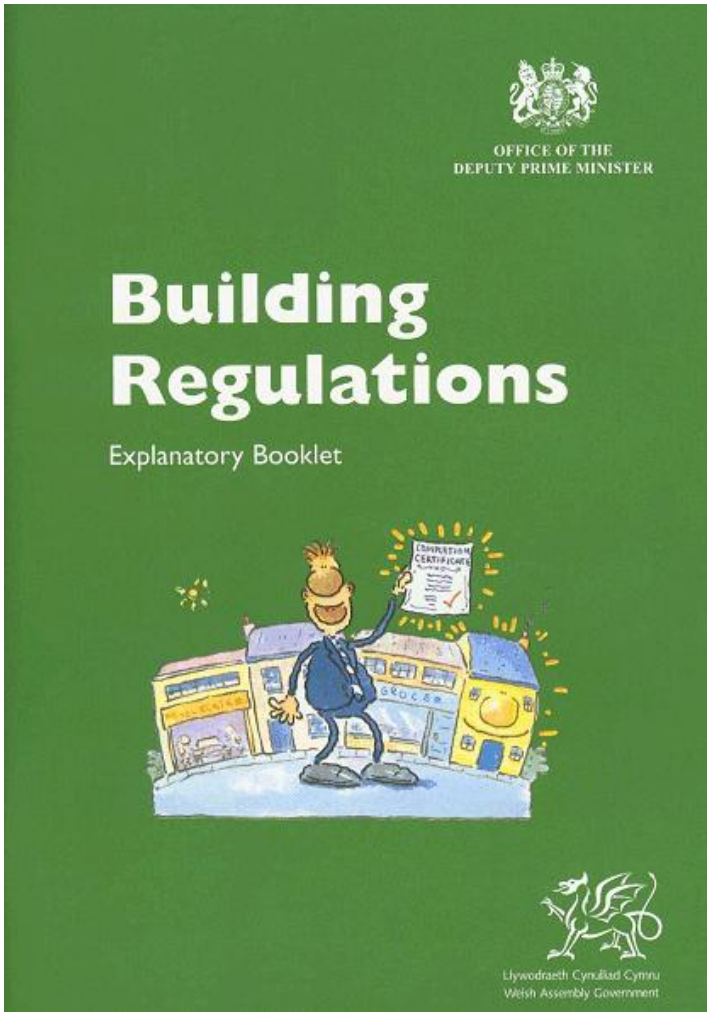
# Typical Architectural Drawings

## Modern Floor Plan




## 16th century town plan

# Policies and Procedures




nehta

**Interoperability Framework**

Version 2.0 — 17 August 2007

Australian National eHealth Transition Authority

# The Zachman Framework

ENTERPRISE ARCHITECTURE - A FRAMEWORK ™

| | DATA *What* | FUNCTION *How* | NETWORK *Where* | PEOPLE *Who* | TIME *When* | MOTIVATION *Why* | |
|---|---|---|---|---|---|---|---|
| SCOPE (CONTEXTUAL) *Planner* | List of Things Important to the Business<br>ENTITY = Class of Business Thing | List of Processes the Business Performs<br>Function = Class of Business Process | List of Locations in which the Business Operates<br>Node = Major Business Location | List of Organizations Important to the Business<br>People = Major Organizations | List of Events Significant to the Business<br>Time = Major Business Event | List of Business Goals/Strat<br>Ends/Means=Major Bus. Goal/ Critical Success Factor | SCOPE (CONTEXTUAL) *Planner* |
| ENTERPRISE MODEL (CONCEPTUAL) *Owner* | e.g. Semantic Model<br>Ent = Business Entity<br>Reln = Business Relationship | e.g. Business Process Model<br>Proc. = Business Process<br>I/O = Business Resources | e.g. Logistics Network<br>Node = Business Location<br>Link = Business Linkage | e.g. Work Flow Model<br>People = Organization Unit<br>Work = Work Product | e.g. Master Schedule<br>Time = Business Event<br>Cycle = Business Cycle | e.g. Business Plan<br>End = Business Objective<br>Means = Business Strategy | ENTERPRISE MODEL (CONCEPTUAL) *Owner* |
| SYSTEM MODEL (LOGICAL) *Designer* | e.g. Logical Data Model<br>Ent = Data Entity<br>Reln = Data Relationship | e.g. "Application Architecture"<br>Proc. = Application Function<br>I/O = User Views | e.g. "Distributed System Architecture"<br>Node = I/S Function (Processor, Storage, etc)<br>Link = Line Characteristics | e.g. Human Interface Architecture<br>People = Role<br>Work = Deliverable | e.g. Processing Structure<br>Time = System Event<br>Cycle = Processing Cycle | e.g., Business Rule Model<br>End = Structural Assertion<br>Means = Action Assertion | SYSTEM MODEL (LOGICAL) *Designer* |
| TECHNOLOGY MODEL (PHYSICAL) *Builder* | e.g. Physical Data Model<br>Ent = Segment/Table/etc.<br>Reln = Pointer/Key/etc. | e.g. "System Design"<br>Proc = Computer Function<br>I/O = Screen/Device Formats | e.g. "System Architecture"<br>Node = Hardware/System Software<br>Link = Line Specifications | e.g. Presentation Architecture<br>People = User<br>Work = Screen Format | e.g. Control Structure<br>Time = Execute<br>Cycle = Component Cycle | e.g. Rule Design<br>End = Condition<br>Means = Action | TECHNOLOGY CONSTRAINED MODEL (PHYSICAL) *Builder* |
| DETAILED REPRESENTATIONS (OUT-OF-CONTEXT) *Sub-Contractor* | e.g. Data Definition<br>Ent = Field<br>Reln = Address | e.g. "Program"<br>Proc = Language Stmt<br>I/O = Control Block | e.g. "Network Architecture"<br>Node = Addresses<br>Link = Protocols | e.g. Security Architecture<br>People = Identity<br>Work = Job | e.g. Timing Definition<br>Time = Interrupt<br>Cycle = Machine Cycle | e.g. Rule Specification<br>End = Sub-condition<br>Means = Step | DETAILED REPRESENTATIONS (OUT-OF CONTEXT) *Sub-Contractor* |
| FUNCTIONING ENTERPRISE | e.g. DATA | e.g. FUNCTION | e.g. NETWORK | e.g. ORGANIZATION | e.g. SCHEDULE | e.g. STRATEGY | FUNCTIONING ENTERPRISE |

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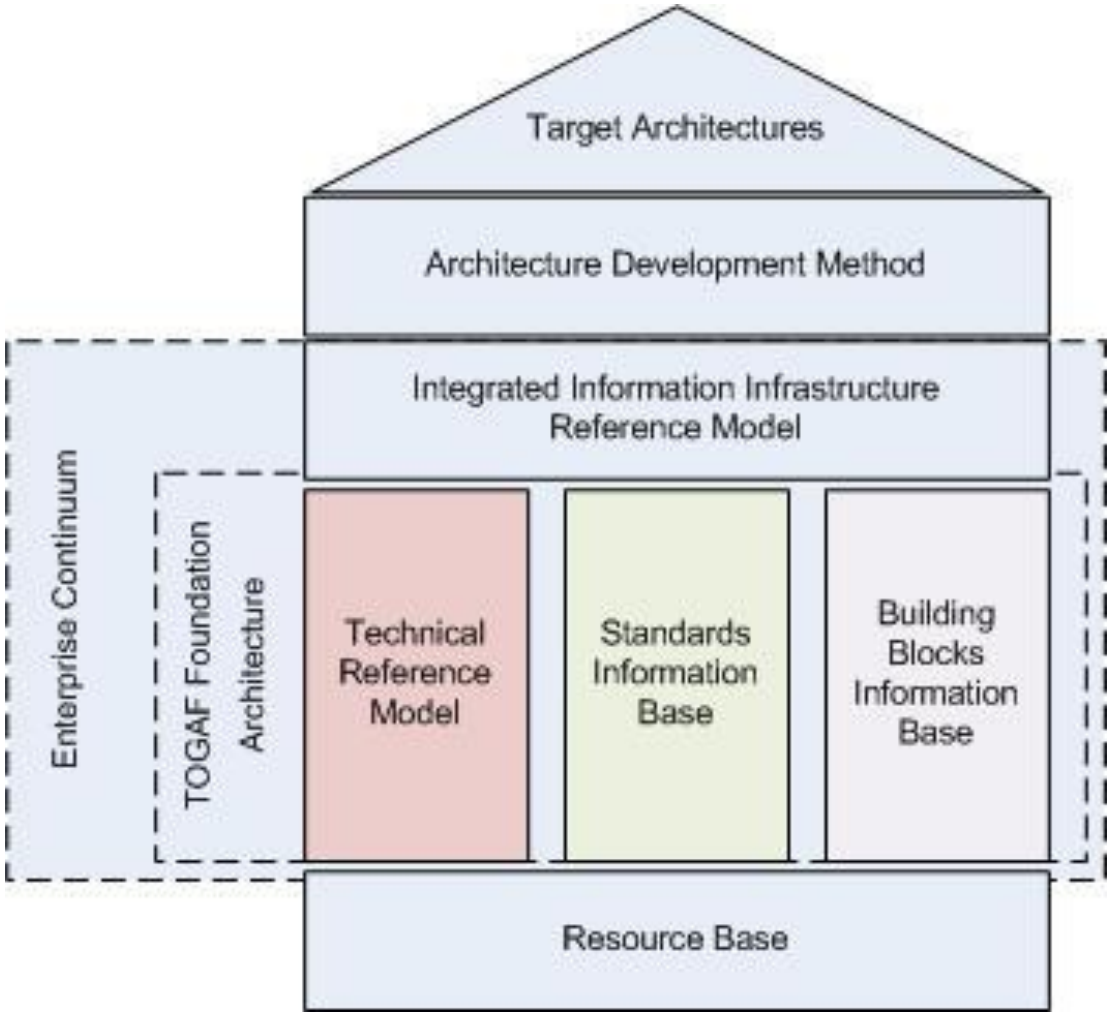
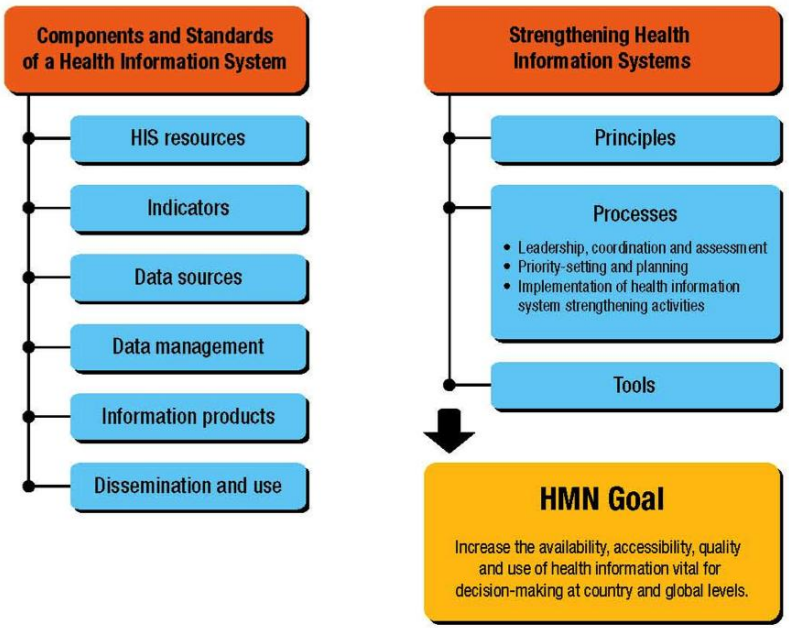
# The Open Group Architectural Framework (TOGAF)



# The Health Metrics Network Framework

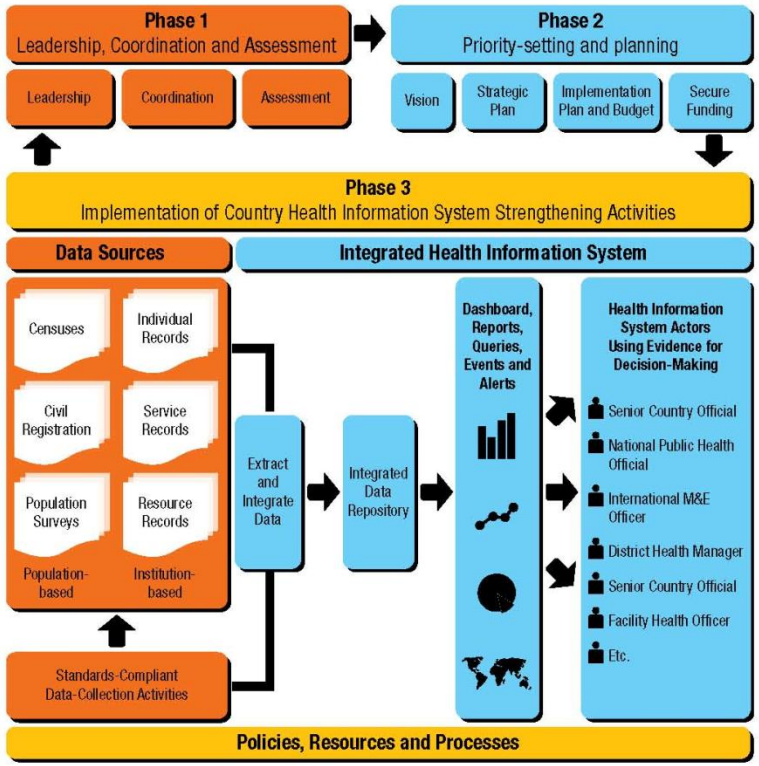
## The HMN Framework (version 2)

Fig 1. The HMN Framework




## Roadmap for Implementing the HMN Framework

Fig 14. Roadmap to applying the HMN Framework and standards for country health information systems



# Example: National TB Control Program



# WHO Guideline for TB Treatment

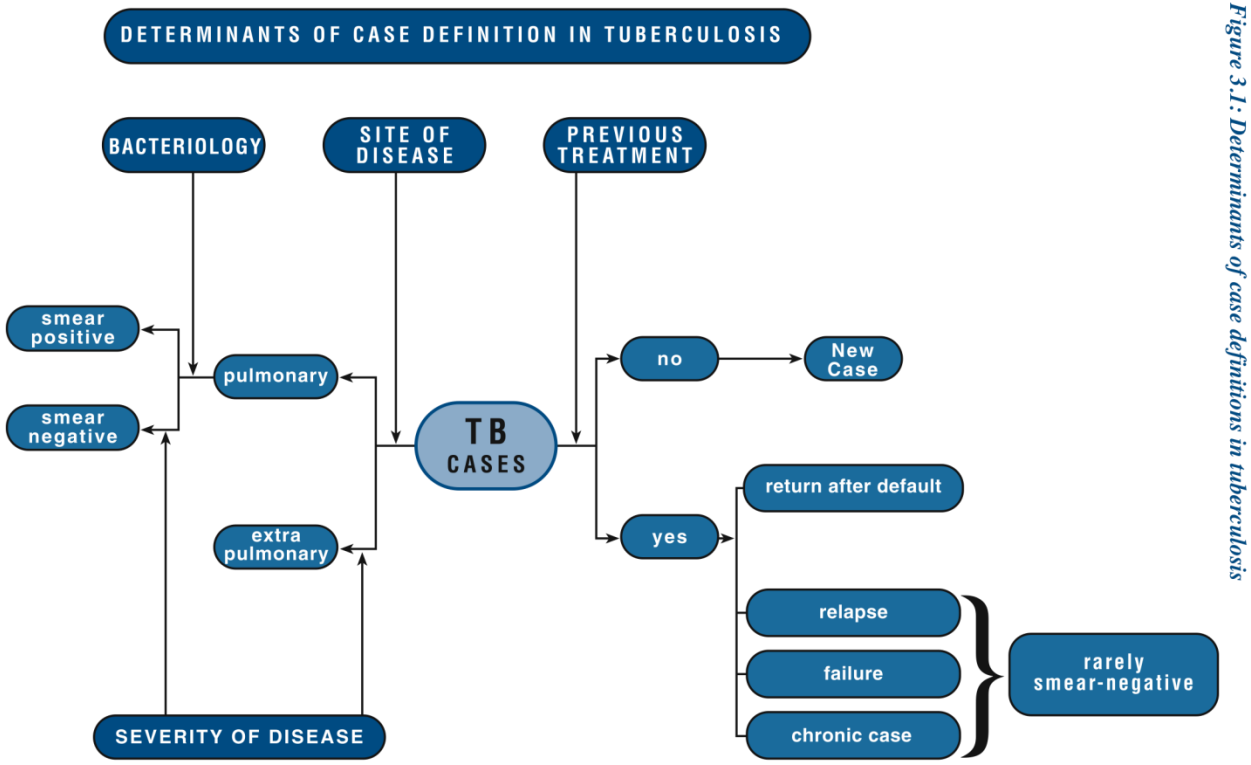
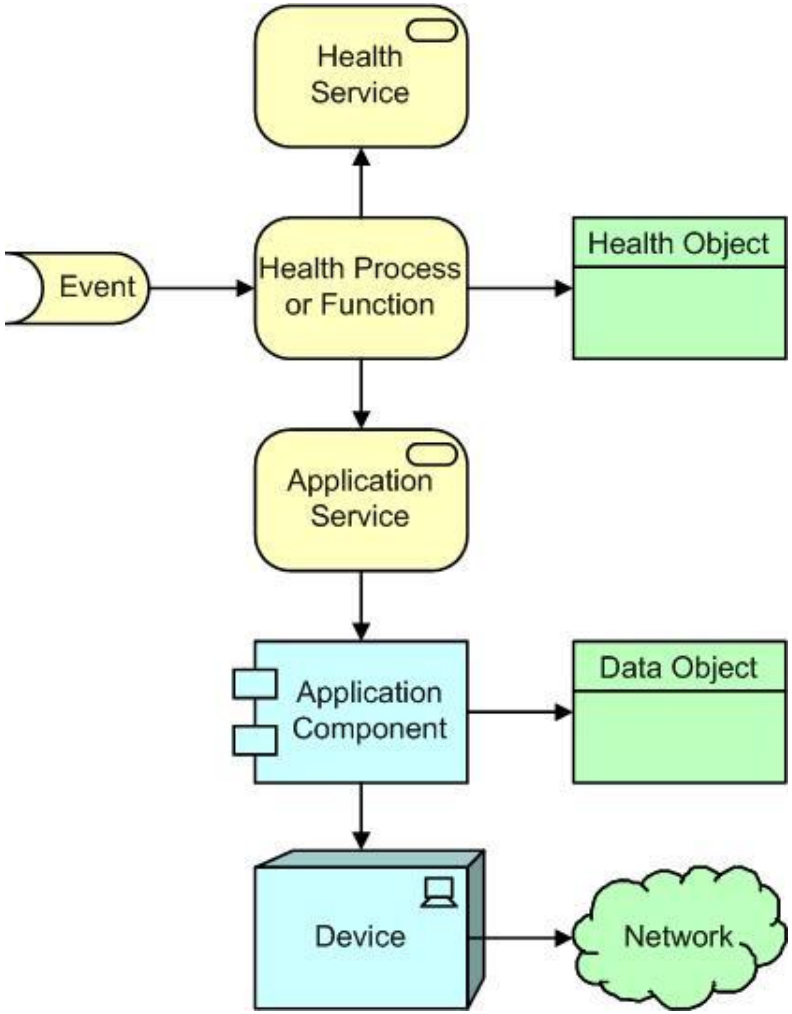



*Figure 3.1: Determinants of case definitions in tuberculosis*

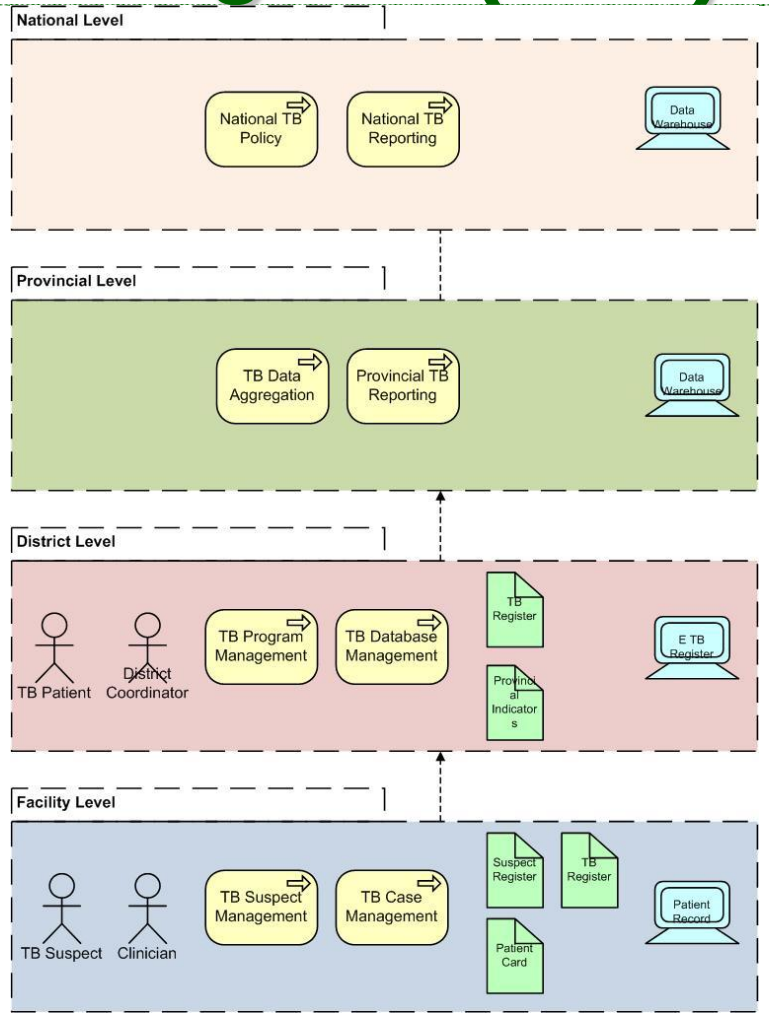
# Archimate Notation and Modeling Language



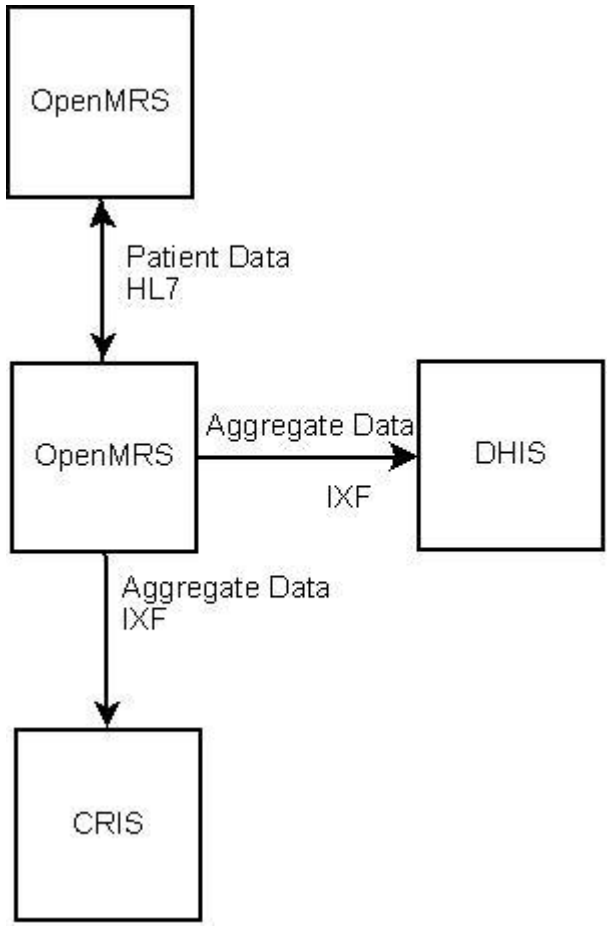
# National TB Control Program (NTP)

Fig 2. Information needs and tools at different levels of data collection

| Level of data collection | Quantity of data | Information needs | Information tools |
|---|---|---|---|
| Global/Regional | Less | Summary indicators for global reporting e.g. MDGs, UNGASS | Global/Regional summary reports |
| National | | Summary indicators for national needs, e.g. strategic planning and resource allocation | National summary reports |
| District | | Indicators for district and national reporting and planning | District summary reports |
| Facility | | Facility management, audits, planning, drug procurement | Facility registers, logbooks |
| Patient | | Patient care | Patient charts |
| Household and community | More | Understanding population burden of disease and risk; Monitoring and Evaluation of CBOs | Household surveys, census, civil registration and demographic surveillance |

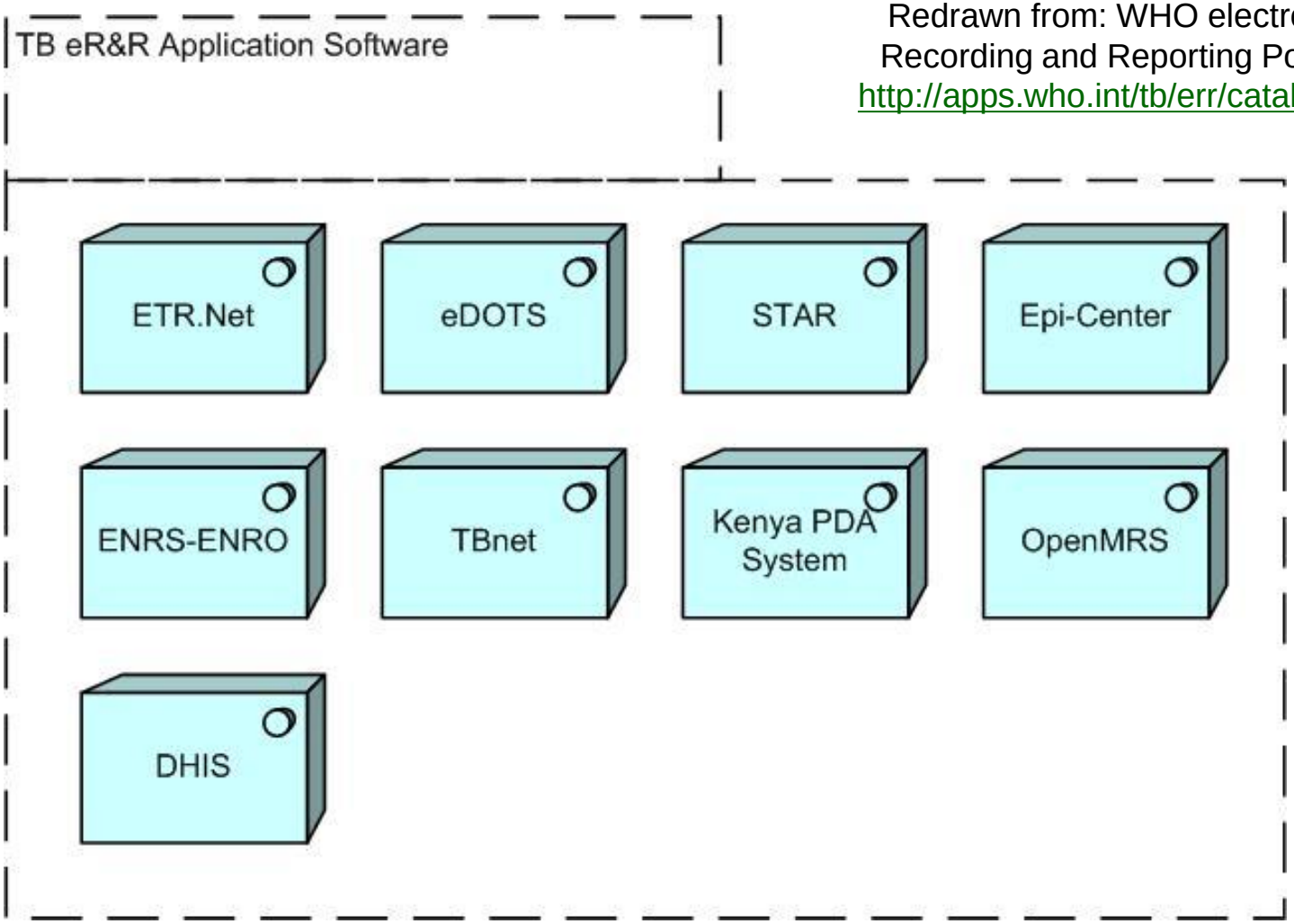


# Standards-based Data Integration

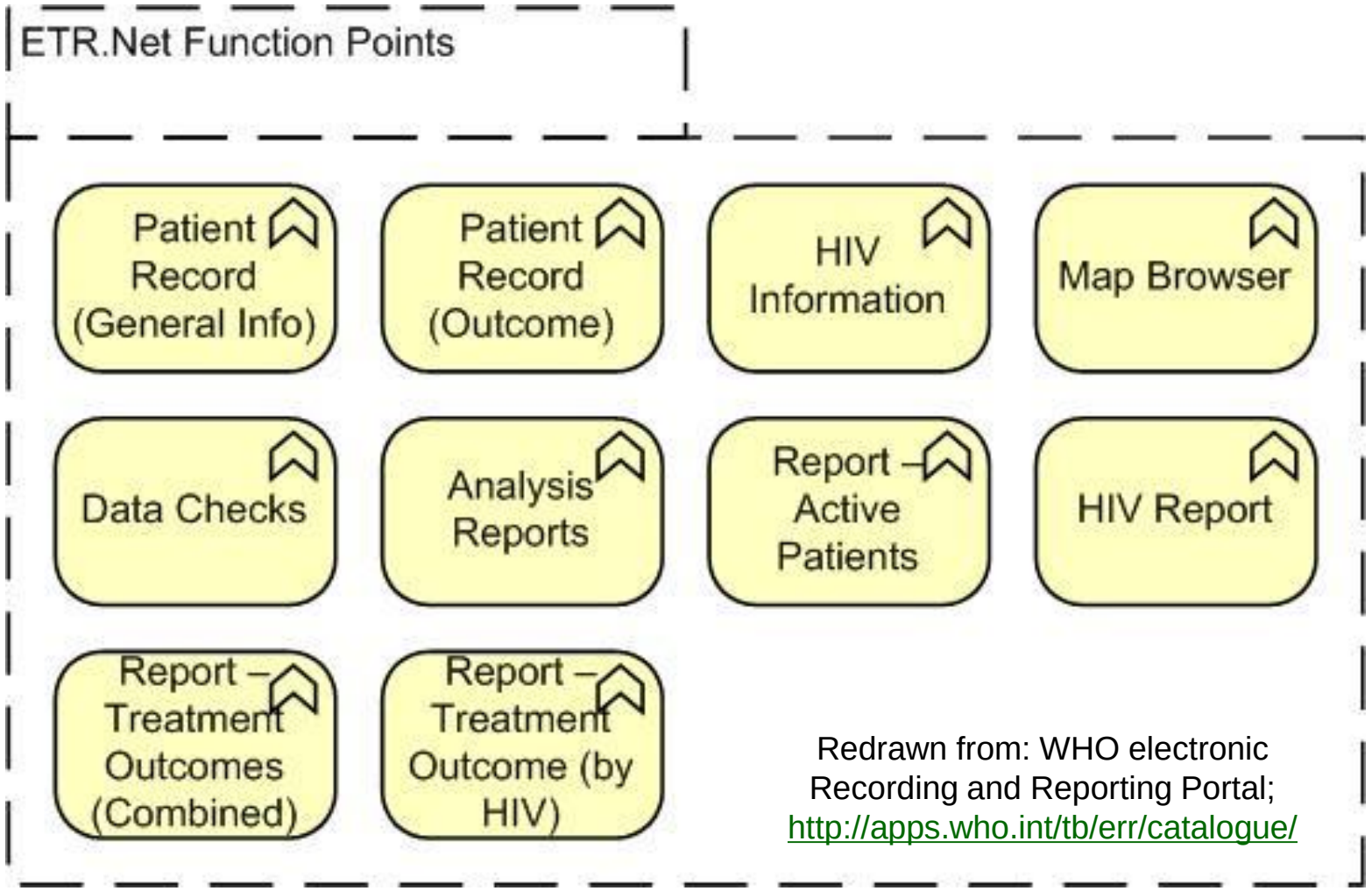


# National TB Control Program

Redrawn from: WHO electronic Recording and Reporting Portal; http://apps.who.int/tb/err/catalogue/



# ETR.Net Function Point Analysis

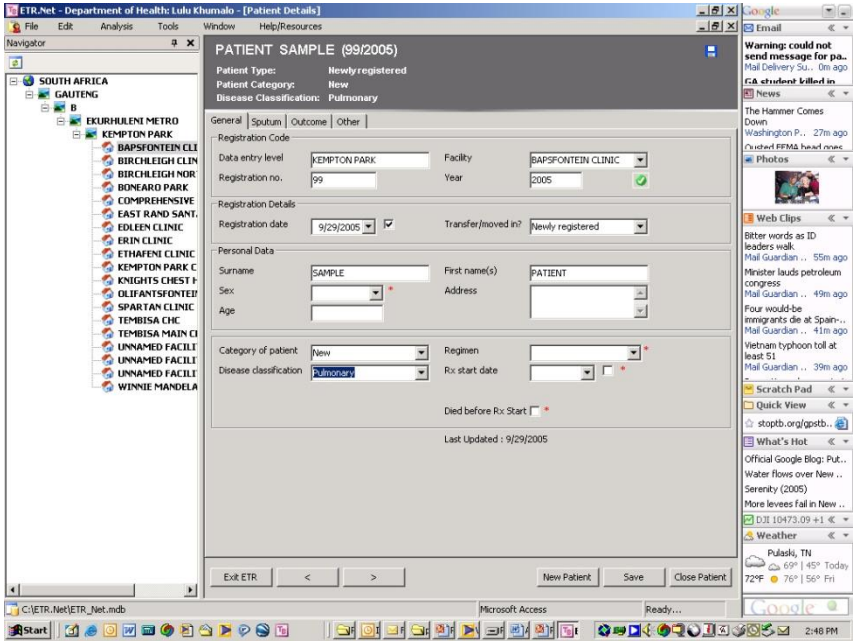



Redrawn from: WHO electronic Recording and Reporting Portal; http://apps.who.int/tb/err/catalogue/

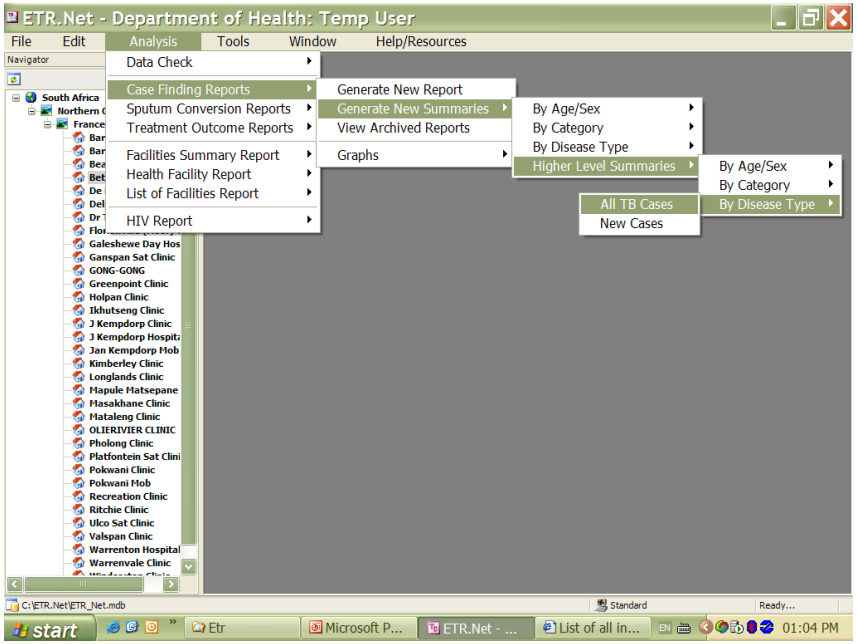
# ETR.Net Functions

Reference: WHO electronic Recording and Reporting Portal; http://apps.who.int/tb/err/catalogue/

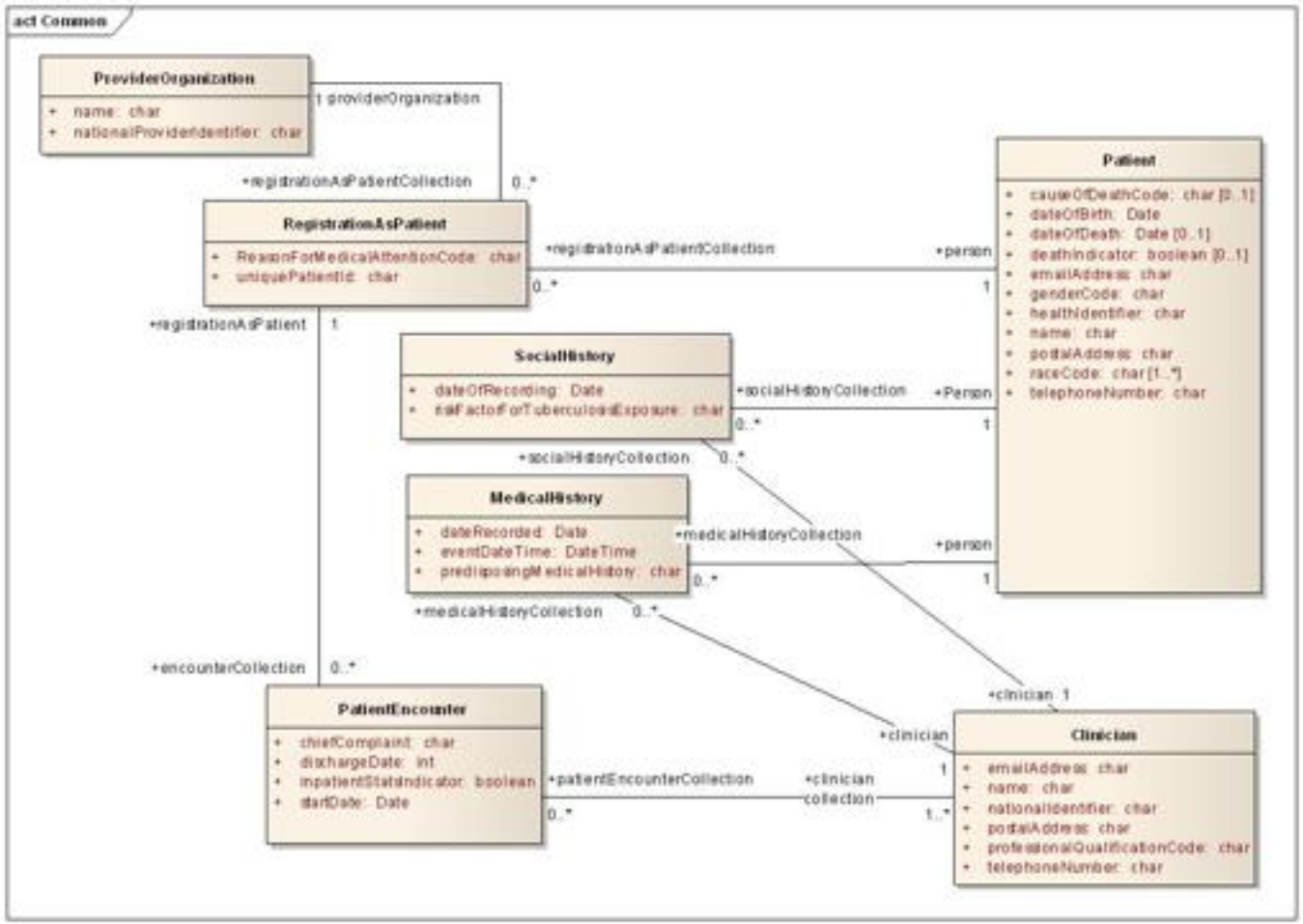
## Patient Record




## Analysis Reports

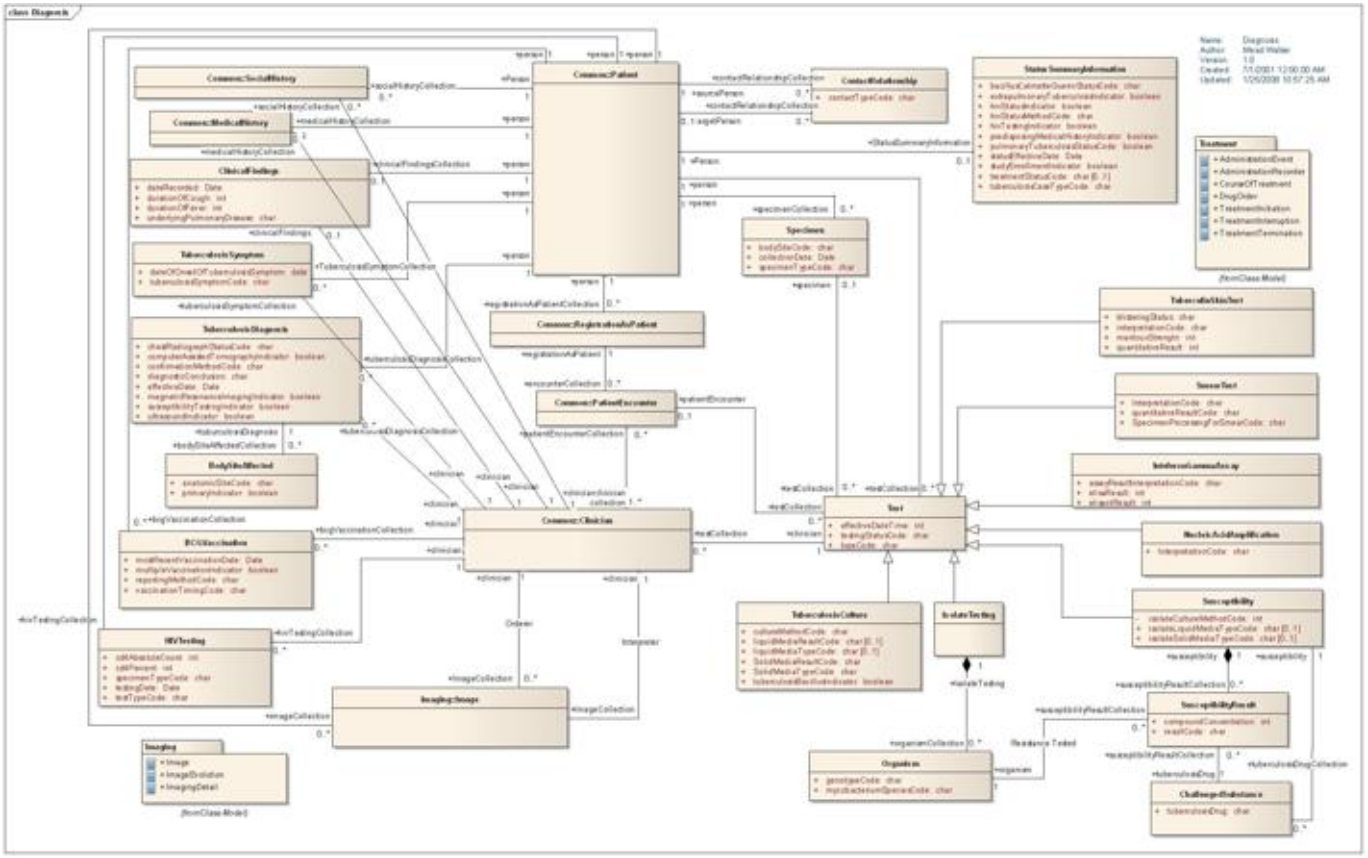


# A Standard TB Class Diagram



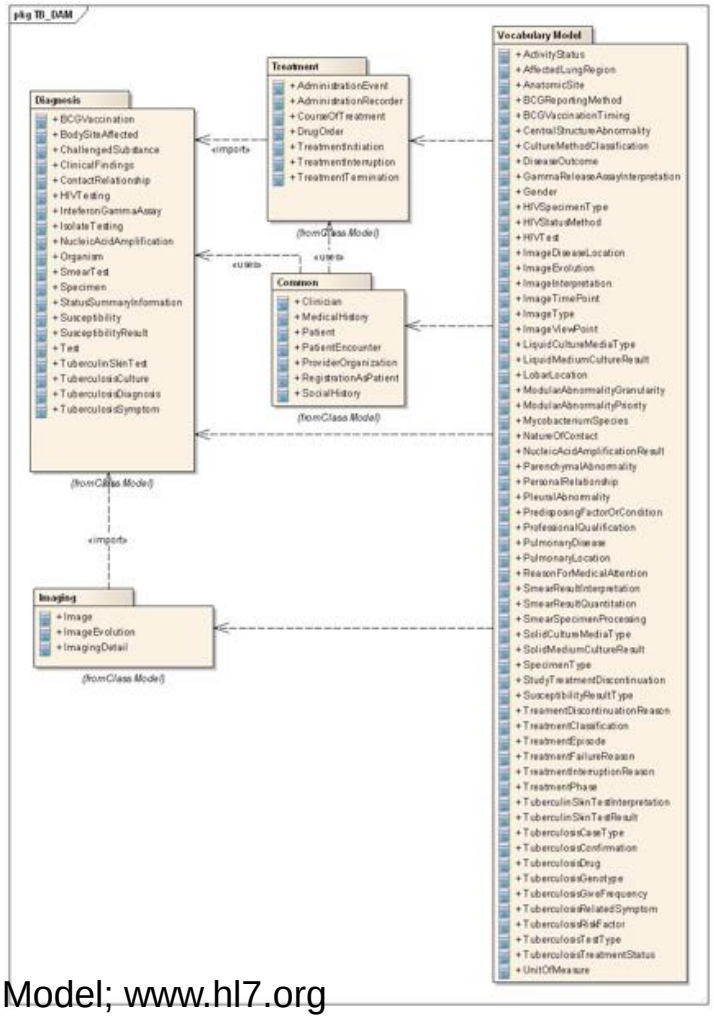

Reference: HL7 TB Domain Model; www.hl7.org

# A TB Diagnosis Class Diagram



Reference: HL7 TB Domain Model; www.hl7.org

# A Standard TB Data Model




Reference: HL7 TB Domain Model; www.hl7.org

# Semantic Table and Field Definition

## Diagnosis::ClinicalFindings

***public Class:*** Relevant information the person's tuberculosis related experience. It represents the summation of information captured in the context of a patient encounter. This includes the answers to questions posed to the patient, as well as the record of observations made by a clinician, or of other actions taken within the context of an encounter.

***Diagnosis::ClinicalFindings Attributes***

| Attribute | Type | Notes |
|---|---|---|
| dateRecorded | public : *Date* | The date on which the clinial finding item was recorded. |
| durationOfCough | public : *int* | The number of weeks that the cough persisted as reported by the patient. |
| durationOfFever | public : *int* | The number of weeks that the fever persisted as reported by the patient. |
| underlyingPulmonaryDisease | public : *char* | A coded indication of the type of underlying pulmonary disease.<br><br>CADSR Local Value Domain = 'PulmonaryDisease' |

Reference: HL7 TB Domain Model; www.hl7.org

# A Pattern Language?

## Organizational Rights Pattern

Reference: NEHTA Interoperability Framework, Version 2.0, 17 August 2007

- **Four elements:**
  - **A role of right-holder (e.g. patient in a public hospital), a role representing the other party (e.g. doctor in an emergency department), and an authority role, describing the initial granting of the rights (e.g. government granting all citizens the rights to healthcare);**
  - **a permission that applies to the role of right-holder to perform some actions**
  - **an obligation that applies to the role of right-grantor, with respect to the specified action;**
  - **action to which the rights apply.**